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Research Note

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REGENERATING LODGEPOLE PINE IN CENTRAL MONTANA FOLLOWING CLEAR CUTTING

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ABSTRACT

Reports a 10-year study in central Montana of stocking and density of regeneration on different kinds of seedbeds and on seed dispersal from standing timber. In each of 7 years, seed did not disseminate beyond 3 chains (about 200 feet) into clear cuttings in quantities sufficient for reproducing a stand. Usually about two-thirds of the total number of seeds released in a year fell during the period October to June.

After 10 years, no significant changes in density or stocking were apparent except on burned seedbeds, which were adequately stocked but not overstocked; other seedbeds were overstocked. Discusses new recommendations for slash disposal to meet different management objectives.

INTRODUCTION

Careful treatment of cone-bearing logging slash is necessary to assure prompt and complete natural restocking of clear-cut blocks of lodgepole pine (Pinus contorta Dougl.) in central Montana. Boe reached this conclusion after evaluating results of a 5-year study on relations of seedling density and stocking to seedbed conditions.[2] He

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[2] Boe, Kenneth N. Regeneration and slash disposal in lodgepole pine clear cuttings. Northwest Sci. 30: 1-11, illus. 1956.

also analyzed patterns of seed dispersal from bordering uncut timber into a clear cutting and the adequacy of seed from this source for the regeneration of clear-cut blocks. Observations on his study plots were continued for a second 5-year period. This paper reports the status of regeneration in the study areas 10 years after their establishment.

METHODS

A summary of experimental methods described by Boe is presented here for convenience.

The study was located in pure, even-aged, overmature stands on the Lewis and Clark National Forest at elevations of 6,500 to 7,100 feet. Slash treatments were carried out in the fall of 1949 on block clear cuttings of from 30 to 50 acres each made in the previous winter and spring. The randomized block design included four methods of slash disposal replicated six times. Three replications were on north-facing and three on south-facing slopes.

Slash treatments were:

1. Burning slash windrows and concentrations
2. Burning scattered slash piles made by bulldozer
3. Lopping and scattering slash, and
4. No treatment, as a check.

Logging and the slash treatments listed above created the following seven kinds of seedbeds which were named for their principal distinguishing characteristics:[3]

1. Burned, piled slash
2. Burned, slash windrows and concentrations
3. Slash, windrows and concentrations
4. Forest floor
5. Skidroads
6. Scarified, bulldozer
7. Slash, lopped and scattered.

Randomly located milacre plots sampled reproduction on each type of seedbed.

Seed dispersal was studied by placing $\frac{1}{4}$-milacre seedtraps at 1-chain intervals within the timber at either side of and across one clear cutting (Adams Creek). Seed was collected from the traps and examined at several intervals during each year. The first period of seedfall study was 1950-1953.[4]

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[3] "Seedbed" as used in this paper means the mineral soil and any covering materials that were present.

[4] Boe, op. cit., p. 2.

Seed dispersal was observed for 2 more years on Adams Creek. In addition, data on seed dispersal were recorded from 1955 to 1957 on Wolsey Creek. Here the elevation was lower and the seedtraps were oriented on a north-south line in contrast to the east-west orientation on Adams Creek to see whether the dispersal pattern would be different.

RESULTS

SEED DISPERSAL

The first 3 seed years of record (1950 through 1952) showed that only small quantities of seed, insufficient for reproducing a stand, are dispersed beyond 3 chains from a timber edge. This pattern of dispersal was verified during 1953 and 1954 at Adams Creek as well as at Wolsey Creek in 1955 and 1956 (fig. 1).

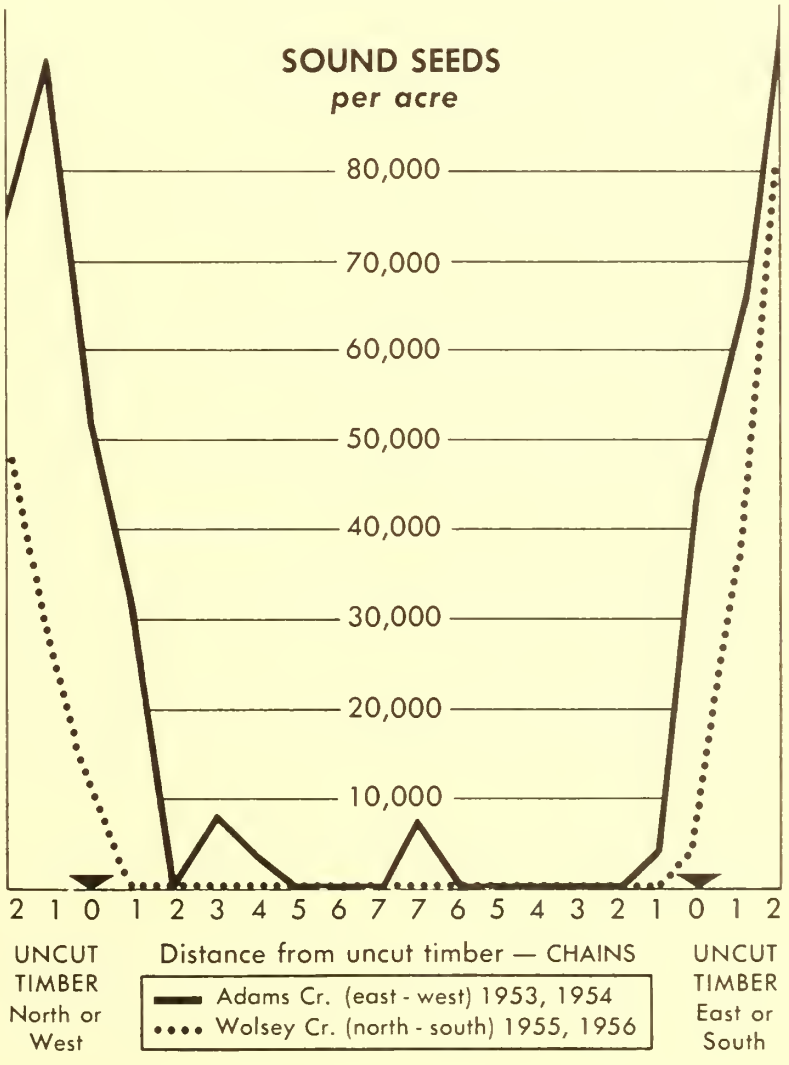

Figure 1.--Dispersal of sound lodgepole pine seed into clear cuttings from adjacent mature timber during 4 seed years (Adams Creek, 1953 and 1954; Wolsey Creek, 1955 and 1956, Lewis and Clark National Forest, Montana).

The annual distribution of seedfall during the first 3 years of study was also confirmed by further sampling. The pooled percentage dispersal throughout the year for both the Adams Creek and Wolsey Creek areas during 4 seed years (1953-1956) is compared with earlier findings (table 1). The combined dispersal percentages for the entire period of study were computed by weighting dispersal figures for each area by the number of years of observation of the area. The final percentages are based on observations for 7 seed years. Generally, about two-thirds of the annual seed crop that is released is dispersed during the period of October through May.

Table 1.--Percentage of lodgepole pine seed released from uncut stands in central Montana by periods

Period of year	Adams Creek	Adams Creek and Wolsey Creek	
	1950-1952 [1]	1953-1956 [1]	1950-1956 [1]
	Percent		
August-September	20	18	19
October-May	62	70	66
June-July	18	12	15

[1] Seed years.

Although most of the seed dispersed probably came from nonserotinous cones, Clements [5] long ago reported evidence to indicate that some could have come from older serotinous cones that opened several years after maturity.

STOCKING AND DENSITY

Stocking and density of lodgepole pine trees in the 10th year following cutting and slash treatment are shown in table 2, together with similar previously published data for the first, second, and fifth years. After 10 years, differences in stocking are still highly significantly related to differences in type of seedbed. Also, the difference in stocking between aspects and the treatment-aspect interaction proved to be non-significant.

[5] Clements, F. E. The life history of lodgepole burn forests. U.S. Dept. Agr. Forest Serv. Bull. 79, 56 pp., illus. 1910.

Table 2.--Percent of stocking and numbers of trees per acre by type of seedbed

Seedbed	Distribution: stocked milacre quadrats				Density: trees per acre	
	1950	1951	1954	1960	1954	1960
	Percent				Number	
Burned, piled slash	15	15	28	38	860	1,067
Burned, windrows and concentrations	24	18	28	40	720	900
Slash, windrows and concentrations	38	28	45	47	1,880	1,867
Forest floor	78	74	80	84	7,010	7,433
Skidroad	95	88	96	94	10,380	10,067
Scarified, bulldozer	83	81	88	93	10,730	10,733
Slash, lopped and scattered	83	76	82	82	9,910	8,800

By 1954 stocking increased notably on the two burned seedbeds. One question asked then was whether further improvement would occur on the burns. Between the fifth and tenth years the number of trees per acre increased significantly to an acceptable level on both of the burned seedbeds. Stocking also increased, and the rate of stocking, although not optimum under earlier standards, is now considered adequate.[6] On other seedbeds no real changes in stocking or density took place during this period.

[6] Optimum stocking in 1952 was assumed to be between 65 to 75 percent of milacre quadrats; 40 percent is now considered adequate.

DISCUSSION AND CONCLUSIONS

Boe's recommendations for disposing of logging slash and rapidly obtaining lodgepole pine regeneration were based on results of the first 5 years of this study. Results of the additional 5 years of study reported here support his original findings related to quick establishment and survival of regeneration.

On most seedbeds where regeneration was established quickly and survival was good, the stands are now too dense. Conversely, burned seedbeds that had been declared understocked during the first 5 years following cutting improved during the second 5-year period. Three seed sources probably contributed to this improvement:

1. Serotinous cones (in the slash) that escaped the damaging effects of fire.

2. Cones that opened on standing overmature timber surrounding the clear cuttings.

3. Nonserotinous cones on reproduction from 5 to 10 years old.

The early variations in stocking and density on the different seedbeds and their status after 10 years have definite practical implications. They suggest a need for some changes in application of slash disposal methods.

In areas where timber production is the highest use, obtaining early regeneration at adequate density should be the primary goal. Results from this study show that this goal can be achieved on burned seedbeds, provided they are adequately supplied with seed. However, extremely careful burning of slash is required to avoid destruction of all seed-bearing cones. Moreover, at least a few well-distributed trees must become established on the burned seedbeds very soon after logging and supply seed to fill in areas not supplied by adjacent timber. At least 75 percent of the area should have a burned surface after slash treatment. Such a seedbed has a better chance of creating optimum-stocked stands than most seedbeds produced by current practice, but it will require a longer regeneration period.

In areas where it seems imperative to restore tree cover rather soon after logging, no changes from present practices are proposed. Dozer bunching of slash either in small, well-distributed piles or short windrows reduces fire hazards to acceptable levels and provides conditions suitable for the immediate establishment of reproduction. All seedbeds except burned ones and those where heavy slash concentrations remain are naturally supplied with adequate quantities of seed and become restocked promptly. The original recommendation to keep burned seedbeds small (1/20 acre or smaller) and well distributed and to be sure that they occupy no more than 25 percent of the total area should be followed. This type of slash treatment can be recommended for areas subjected to heavy recreational use and for soils having high erosion potentials.

These suggested practices have resulted frequently in overly dense stands of reproduction, which pose a threat against attainment of optimum usable growth. The need for precommercial thinning in these stands is obvious. As more lodgepole pine timber is cut, overstocked stands are fast becoming the most serious challenge to the technical knowledge and skill of practicing foresters in this type. New techniques in slash disposal must be considered for general use in timber management if natural regeneration is the aim.

Forest managers in central Montana must be alert to alternatives in slash disposal when they plan cuttings in lodgepole pine. Piling dry slash with a bulldozer usually results in prompt overdense regeneration, which requires early thinning to control density. Prompt regeneration well spaced may also be obtained by planting, but at a greater cost than natural regeneration. Greater use of fire in slash disposal may result in a uniform seedling stand of acceptable density, but it would require a longer time than the other methods mentioned. Because refinements in methods of disposing of lodgepole pine slash offer promise in obtaining acceptable stands as less cost, further research on seed supplies and on disposal methods is needed.